

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

POC0335 – ORGANIC CHEMISTRY

(Foundation in Life Sciences students only)

29 MAY 2017
2.30 p.m. – 4.30 p.m.

(2 Hours)

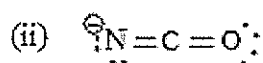
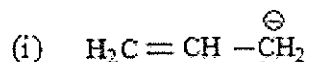
INSTRUCTIONS TO STUDENT

1. This question paper consists of 6 pages only excluding the cover page.
2. Answer ALL questions.
3. Please write all your answers in the answer booklet provided.
4. Distribution of marks for each question is given.

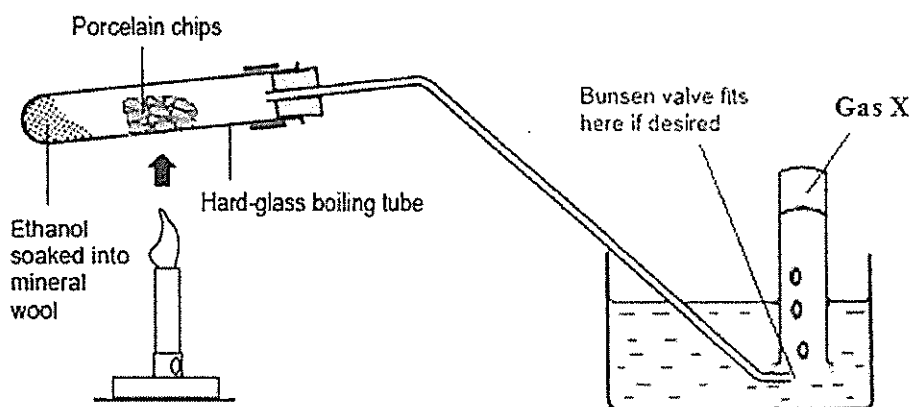
Instructions: Answer ALL questions.

Question 1 [20 marks]

a. Write the contributing resonance structures for the following: [2 × 1 mark]

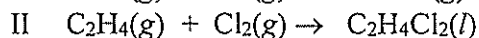
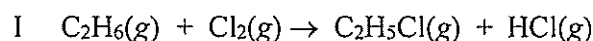


b. Gas X is produced when ethanol vapour is passed over heated porcelain chips using the apparatus shown as below.



- (i) Give the name and molecular formula of gas X. [1 mark]
- (ii) To which homologous series does X belong? [1 mark]
- (iii) Name the reaction that takes place in the boiling tube. [1 mark]
- (iv) Write an equation to show the formation of gas X. [2 marks]

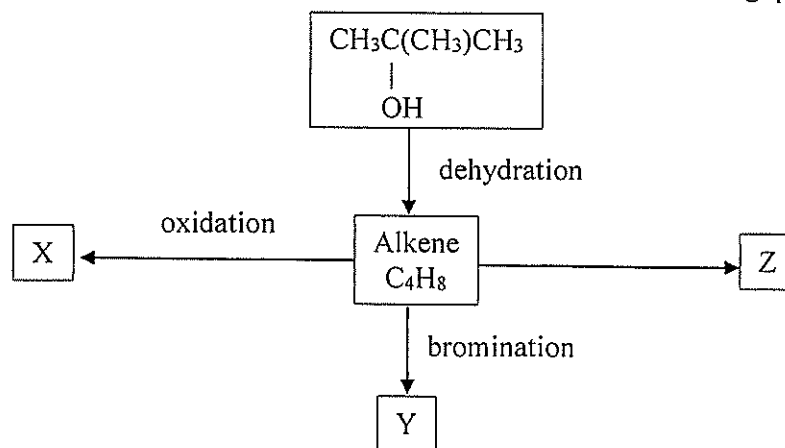
c. Chlorine reacts with ethane and ethene according to the equation below:



- (i) State the conditions for reaction I and II. [2 marks]
- (ii) Why do ethane and ethene react differently with chlorine? [2 marks]
- (iii) What colour change is observed for chlorine in both reactions I and II? [1 mark]

Continued.....

d. Study the reaction scheme below and use it to answer the following questions.



- (i) Dehydration of an alcohol produces an alkene. Give the reagents and conditions needed to carry out the above dehydration. [1 mark]
- (ii) (1) Give the reagent needed to undergo oxidation. [1 mark]
(2) Give the molecular formula of X. [1 mark]
- (iii) (1) What is observed when alkene undergoes bromination? [1 mark]
(2) Give the molecular formula of Y. [1 mark]
- (iv) Describe how you can convert the alkene into the saturated hydrocarbon Z (state the chemical equation). [3 marks]

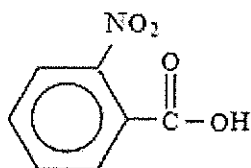
Question 2 [20 marks]

a. Draw the structure for each of the following. [3 × 2 marks]

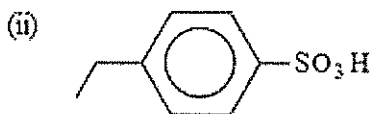
- (i) 4-methylbenzaldehyde
(ii) *o*-bromotoluene
(iii) 1-bromo-1-phenylethane

b. Write all the reactions involved (with the correct sequence) for preparing the following compounds from benzene.

(i) [3 marks]



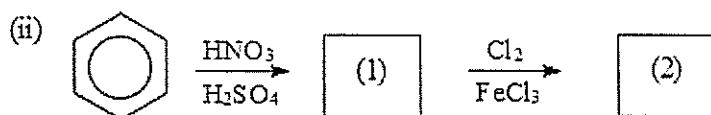
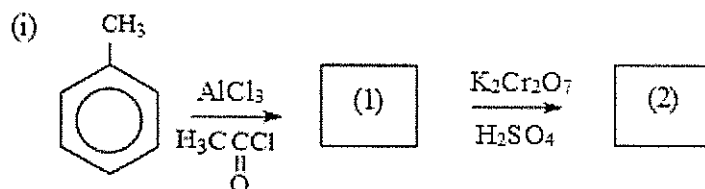
(ii) [2 marks]



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c. Draw the structure of the products formed and state the reaction.

[4 × 2 marks]



d. Benzene is more stable than you might expect based upon a six-membered ring and three double bonds. This is because benzene has _____. [1 mark]

Question 3 [20 marks]

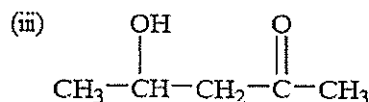
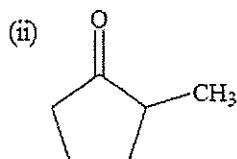
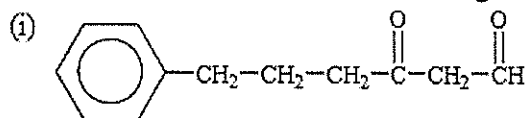
a. Fill in the blank for the following:

[3 × 1 mark]

- When an aldehyde is considered as a group, it is called _____ group.
When a ketone cannot be named as an -one, it is named as an _____ group.
- An oxidizing agent that can oxidize an alcohol to an aldehyde without going all the way to an acid is (write the whole name) _____.
- A positive Tollen's test for aldehydes is indicated by _____.

b. Give the IUPAC names for the following structures.

[3 × 2 marks]



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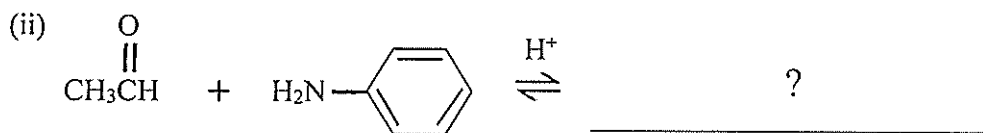
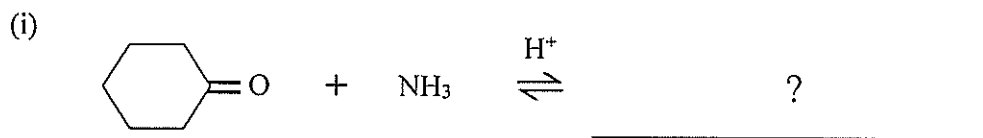
c. The boiling points of the three compounds are provided below:

| | CH ₃ CH ₃ | CH ₃ NH ₂ | CH ₃ OH |
|--------------------------|---------------------------------|---------------------------------|--------------------|
| Molecular Weight (g/mol) | 30.1 | 31.1 | 32.0 |
| Boiling point (°C) | - 88.6 | - 6.3 | 65.0 |

Explain the reasons for the differences in boiling points as observed among the three compounds of CH₃CH₃, CH₃NH₂ and CH₃OH. [4 marks]

d. Differentiate between an acetal and a hemiacetal. Provide an example for each term to illustrate your answer. [3 marks]

e. An imine is a compound which contains the C=N bond. It is formed by a reaction of an aldehyde or a ketone with ammonia or a 1° amine. Based on this information, complete the following two incomplete reversible chemical equations both of which feature an imine compound as one of the products. [2 × 2 marks]



Question 4 [20 marks]

a. An organic liquid, P, has a molecular formula of C₃H₆O₂. P is a weak organic acid. Describe three chemical reactions (include an example of the chemical equations) that can be carried out to show that P is an acid. (Do not use litmus to test for acidity of P). [3 × 2 marks]

b.

- C₂H₃COOC₂H₅
 - Colourless
 - Sweet smell

An organic compound A has characteristics as mentioned above. It is manufactured by heating compound X and Y in the presence of concentrated sulfuric acid as a catalyst.

(i) Name the process that manufacture compound A. [1 mark]

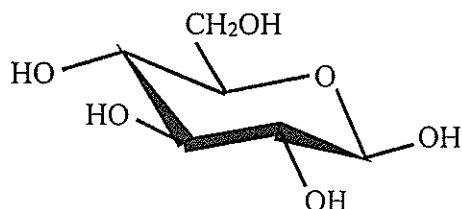
(ii) Construct an equation to represent how compound A is produced. [2 marks]

Continued.....

- (iii) In another reaction, compound A undergoes hydrolysis in an aqueous base.
- (1) Construct an equation of this reaction. [2 marks]
 - (2) Name the reaction. [1 mark]
- c. Discuss the physical properties of (i) boiling point and (ii) solubility in water of carboxylic acids in comparison with other organic compounds of comparable molecular weight. [4 marks]
- d. Suppose you are a chemist in a food factory and you are given the task of producing the flavours for a new line of fruit-flavoured yoghurt products. The artificial flavours that you are required to produce are orange and coconut flavour. It is known that the esters that provide orange flavor and coconut are octyl ethanoate (orange flavour) and butyl heptanoate (coconut flavor). Based on this information, answer the following. [2 × 2 marks]
- (i) What are the raw materials that you will need to synthesize these two esters?
 - (ii) Provide the 2 balanced chemical equations that you will refer to in order to produce octyl ethanoate (orange flavour) and butyl heptanoate (coconut flavor).

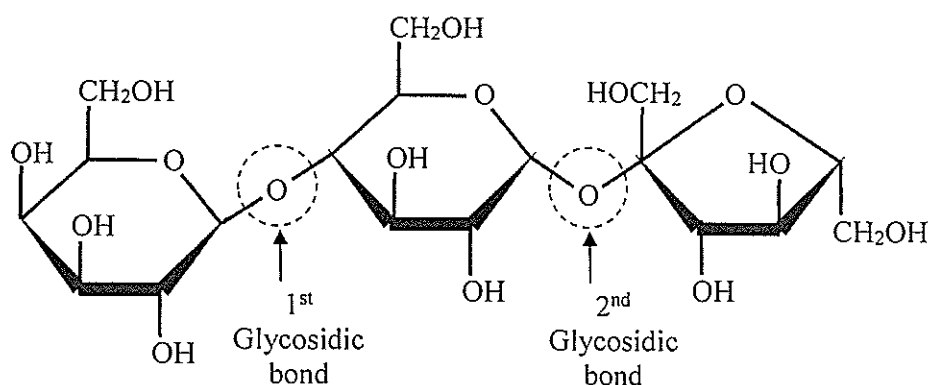
Question 5 [20 marks]

- a. Figure below depicts the chair conformation of β -D-Glucose. This monosaccharide can be reduced to D-Glucitol (an Alditol) by a variety of reducing agents including NaBH_4 . Based on this information, answer the following:
- (i) Draw the Fisher projection of β -D-Glucose. [2 marks]
 - (ii) Draw the Fisher projection of D-Glucitol. [2 marks]

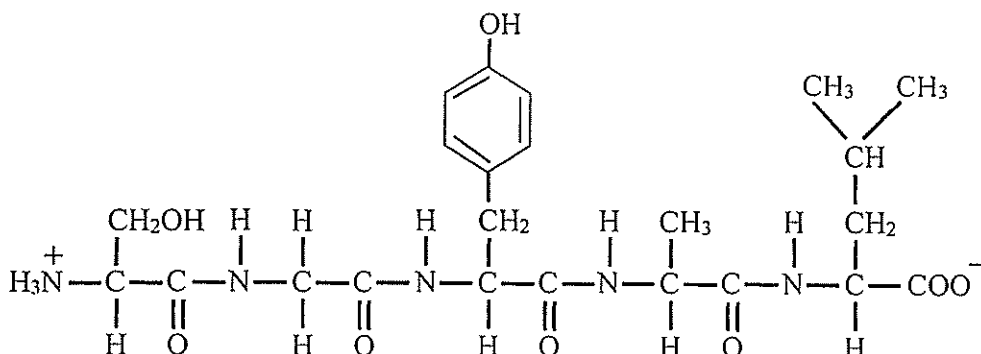


- b. The oligosaccharide called *Raffinose* contains three monosaccharide units as depicted in the diagram below. Based on this diagram,
- (i) Name both the 1st and 2nd glycosidic bonds that are highlighted in the diagram. [1 mark]
 - (ii) Draw the Fisher projection of each of the three individual monosaccharide units. [4 marks]

Continued.....



- c. A dipeptide has an *isoelectric point* (pI) of 5.72. In electrophoresis, predict the direction (does not move, move towards the anode or move towards the cathode) that the dipeptide will move at the following pH: [2 × 1 mark]
- pH 5
 - pH 7
- d. The peptide chain provided below is made up of several amino acids. Based on this information, answer the following.
- How many peptide bonds are there in this peptide chain? [1 mark]
 - Draw the R group for each of the amino acid in this peptide chain. [3 marks]
 - What are the terminal ends of this peptide chain called? [1 mark]



- e. In regards to unsaturated fatty acids, explain how the following two factors affect the melting point of unsaturated fatty acids. The two factors include:
 [Remark: For each factor, explain using any two of the following unsaturated fatty acids as related examples: Palmitoleic acid (16:1); Oleic acid (18:1); Linoleic acid (18:2)].
- The length of the carbon chain, and [1 mark]
 - The degree of unsaturation in the carbon chain. [1 mark]
 - Why is it that saturated fatty acids have higher melting points than unsaturated fatty acids? [2 marks]

End of Paper